REPORT

OF THE

OFFICER IN CHARGE

OF

CONSTRUCTION AND MAINTENANCE OF ROADS, Etc.,

IN THE

YELLOWSTONE NATIONAL PARK

TO THE

SECRETARY OF WAR.

1896.

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ANNUAL REPORT

OF THE

SUPERINTENDENT YELLOWSTONE NATIONAL PARK.

OFFICE OF ROAD CONSTRUCTION,
Mammoth Hot Springs, Wyo., November 9, 1896.

SIR: In compliance with your order of October 27 I respectfully submit a report of park improvements while in my charge, with an estimate for the next fiscal year.

I was placed in charge of this work by Special Order, No. 203, dated August 29, 1894. Accompanying this order was a letter of instructions directing that no new work should be undertaken that autumn, and that the repairs made should be limited to those necessary to put the roads in fair condition and prevent serious deterioration during the spring floods of 1895. I accordingly limited work to repairs of the road near the Virginia Cascades, an extensive repair of the badly washed road in the Gibbon Canyon, and to work on the road between Mammoth Hot Springs and Gardiner. This last work involved the building of a bridge over 100 feet long and the construction of nearly a mile of entirely new road. This was made necessary by the fact that the high water of the preceding spring had carried away the bridge and rendered the road entirely impassable for more than a month, making necessary recourse to the old road over the foothills.

During the winter of 1894–95 I prepared for work in the spring as soon as it was practicable to get on the ground with my working parties. The scheme proposed was to complete the road from the Gibbon Falls to the Fountain Hotel, to begin work on the western approach to the park through the Madison Canyon, to begin work on the eastern approach near Cooke City, and to complete the opening of the road to the south boundary down Snake River.

I placed two surveying parties in the field, one of which located the road from the Gibbon to the Fountain Hotel and also a portion of road to connect this latter with the eastern approach at the junction of the Firehole and Gibbon Rivers. The second party completed the location of the road down Snake River to the south boundary, and then located the road from the Grand Canyon to Yancey's over Mount Washburn.

During this season three lines of work were undertaken. The object of one was to render approach to the park more easy for such as came in their own conveyances from either the east, west, or south. The second was intended to improve the condition of the regular tourist route through the park as then used by the regular transportation company and the extension of this route to the Springs by the way of Yancey's over Mount Washburn. The third was devoted to the opening up of roads passable for light vehicles to points of interest near but not on the regular routes of travel.

The appropriation for the fiscal year ending June 30, 1895, was $30,000, of which $2,000 was allotted to the protection of the park from the ravages of the poachers. The same amount was appropriated for the next fiscal year, with the same deduction of $2,000.

During the summer of 1895, with the remainder of these two appropriations, I completed about 8 miles of new road between the Gibbon and the Fountain Hotel, replacing the old, monotonous, and unmade wagon way by one of the most interesting drives in the park. The timber was grubbed out of about 2 miles of road connecting this with the proposed route down the Madison Canyon. The timber was grubbed out of about 8 miles of road down Snake River, and such grading was done as was necessary to make this route passable for wagons.

Nearly the entire area of the park is situated in the State of Wyoming, and the opening of this road made it possible for the first time to drive a wagon from that State directly into the park.

About 3 miles of the road between Cooke City and Soda Butte were located and finished, cutting out the worst part of this very bad road. Beginning at the Canyon Hotel, the road to Yancey's was grubbed and cleared for nearly 9 miles, which took it nearly to the summit of Mount Washburn.

In addition to this work on the main route and on the approaches I opened a driveway from the Fountain Hotel around by way of Black Warrior and Great Fountain geysers, thus permitting tourists to view these objects of especial interest. I also opened a road to the Lone Star Geyser, a road to the Natural Bridge, completed a road from the main route around by Sulphur Mountain, and ran a full-width, well-graded road down the Grand Canyon to Inspiration Point, and also built a driveway from Yancey's to near the two standing petrified trees that are near his place.

All the old roads were put in a thorough state of repair. Several hundred culverts were put in, either in new places or to replace old ones, and most of the old bridges were redecked and many of them underwent extensive repairs.

In locating the roads in the Madison and the Soda Butte Canyons I adhered to the principle of keeping the roadway on the north side of the stream, where the sun melts the snow out much earlier in the spring, thus making the road passable for a much longer season and avoiding the necessity of expensive and unreliable bridges. To do this, however, in some cases involved the building of roads through difficult country, where the cost of construction was considerably increased.

With the opening of this season I found the appropriations nearly exhausted, but a deficiency appropriation of $5,000 was placed at my disposal, with which I placed the entire circuit of the roads in better condition than they were ever before known to be in the spring of the year.

The snowfall during the winter was so great and the spring so very backward that I found it necessary to employ a considerable force in shoveling snow for the opening of the roads in time for the early travel. I started a crew out from this point on May 14, and they were eight days shoveling the road open to Norris. It was about June 10 before they reached the Lake Hotel, and the 18th when they completed the circuit and arrived at the Upper Geyser Basin.

The appropriation for the current fiscal year was $35,000, of which $5,000 was authorized by the act to be expended in the timber reserve south of the park. As soon as the snow disappeared from the ground I placed three repair crews on the road to fix such places as were left in bad condition by the spring melting. These crews soon completed their work and were then assigned positions on new construction. One surveying party was put in the field, which first located the road across

the timber reserve south of the park to its southern boundary, next completed the location of the road from the east boundary to Soda Butte, and finished by locating a line from Yancey's to the Mammoth Hot Springs.

The grubbing crew cleared and grubbed the road to Riverside; also the road across the timber reserve south of the park, and about 2 miles of the road between Soda Butte and Cooke City. It was then discharged.

The graders completed the road between the Gibbon and the Fountain, and from its junction with the Madison Canyon approach completed the road to the forks of the Madison and down this stream nearly 6 miles. A good bridge was thrown over the Gibbon at the junction and another over the Madison 5 miles down it, thus making this approach to the park passable without the necessity of fording.

The road across the timber reserve has been graded, so that it is passable throughout and in good condition, and a fine bridge has been thrown over the Snake River, which will enable this portion of the road to be used much earlier in the spring than has heretofore been possible.

Short sections of the road between the Lake Hotel and the Thumb had been left without grading—simply in the condition in which the grubbing crew quit them. These have nearly all been put in prime condition, and about 3 miles of heavy sand along the shore of the Thumb have been covered with clay, rendering the roadway solid and good at all times. This part of the road was for a couple of years impassable and necessitated a long detour through the woods, where no roadway had been constructed.

The eastern approach in the Soda Butte Canyon was continued for about 2 miles, so there are now in use nearly 5 miles of the new road, while about a mile more of it has been grubbed and cleared. This is one of the most difficult pieces of road making in the park, as the line is crossed at very short intervals by gulleys, which at times carry large volumes of water from the canyon side. The completion of another mile of this road will cut out all that is worst of the old one and cover all that is most difficult of construction of the new.

The grading crew began work on the road from the canyon to Yancey's, but not more than 2 miles of the road were finished when I found it necessary to discontinue work on account of the low state of the appropriation.

I had measurements made for the construction of a bridge over the Yellowstone River above the upper falls, and through the kindness of Mr. McHenry, chief engineer of the Northern Pacific Railway, plans are now being drawn in his office for an iron bridge at this place. I estimate that it can be completed for a sum not to exceed $5,000, and a small additional sum will open a road on the east side of the canyon as far as opposite Inspiration Point.

I obtained from the engineer officers of the Northern Pacific Railway the exact altitude of the terminus of their road at Cinnabar. From that point I had run a line of levels via Mammoth Hot Springs, Norris, Grand Canyon, and Lake Hotel to the Thumb. These altitudes were marked on each milepost along this part of the tour, as well as on the granite monument already erected near the lake. On this monument I also had engraved its exact latitude and longitude, as accurately determined by the Coast Survey.

Until last summer nothing had been done toward establishing or marking the boundaries of the park. I regarded this as the most important bit of work yet to be accomplished, so I made application for an

officer of the Corps of Engineers to take charge of it. On July 1 Lieutenant Bromwell, Corps of Engineers, reported to me by your order, and was given full charge of this job. A copy of his report is appended. It will be seen that he has placed a monument of cut stone, properly inscribed, on the most easterly point and one on the most southerly point of the Yellowstone Lake, and one similarly inscribed on the most westerly point of Shoshone Lake. These are the determining points of the east, west, and south boundaries of the park. He has also determined and placed monuments, properly inscribed, upon a point on each of these three boundary lines, and also one at the southeast corner of the park. This was a job of considerable expense, as it involved the employment of an assistant and a party with a pack train, as well as the fitting up and continuing in service of the boat on the lake. These points being determined, it remains to locate and definitely and distinctly mark the boundaries of the park, so that no question need arise as to whether or not any particular depredations were committed in the park jurisdiction.

On first taking charge of the work of park improvement I took the responsibility of funds and property pertaining thereto myself. On the arrival of Captain Stevens, assistant quartermaster, at this post in June, 1895, I turned this responsibility over to him and made him the disbursing officer. He was relieved from duty at this post September 1, and I then transferred this responsibility to Lieutenant Forsyth, post quartermaster.

Owing to the fact that Lieutenant Bromwell and his party remained in the field much longer than he had expected, also to the fact that the bridge over Snake River was much more expensive than calculated, I again find the balance on hand for work in the spring much less than I had intended to keep it and insufficient to meet the wants of road repairs in June next. I therefore request a deficiency appropriation of $5,000, "to be available until used."

The main work of road construction still uncompleted requires the building of the road over Mount Washburn to Yancey's and thence to the Mammoth Hot Springs—about 40 miles in all of new road. The greater part of this will be relatively inexpensive, but there are some stretches, aggregating 5 or 6 miles, that will be both costly and difficult. There is every reason why this work should be pushed to a hasty completion, enabling tourists to view from the summit of Mount Washburn some of the grandest mountain scenery in the world. It will be very difficult without more elaborate surveys than I have deemed it essential to make to accurately estimate the cost of this work, but I believe it can be completed for $100,000.

Work should also be continued down the Madison Canyon, certainly as far as Riverside, and the eastern approach should be continued as far as Soda Butte. Some considerable work in the way of betterment should be done between the Thumb and the south boundary of the park along the Snake River road.

Owing to the shortness of the season here during which this work can be prosecuted, not more than $100,000 can be economically expended in one year. I therefore urgently request that this amount be asked from Congress for the work of next season. If it be granted, I feel sure that the sum of $50,000 for the following season will entirely complete the scheme of improvement as planned. After this is done there will remain nothing but the work of annual repairs and the constant betterment of the roads in the way of surfacing, calculated to do away with or lessen the dust and mud nuisances.

The moneys expended for park "protection" have produced good results in the way of numerous trials and convictions of parties for poaching in violation of the act of May 7, 1894. Game of all kinds has multiplied beyond belief under the protection afforded by this act.

Respectfully submitted.

GEO. S. ANDERSON,
Captain, Sixth Cavalry.

The SECRETARY OF WAR.

UNITED STATES ENGINEER OFFICE,
CUSTOM-HOUSE,
St. Louis, Mo., October 28, 1896.

SIR: I have the honor to submit the following report of the season's work in the location of the boundaries of the Yellowstone National Park:

In compliance with Special Orders 125, Adjutant-General's Office, dated Washington, D. C., May 28, 1896, I reported to you for duty July 1, 1896.

Your verbal instructions were to first locate the east and south boundaries of the park and the southeast corner and to mark the boundaries by blazing or cutting out the trees on the line. I was directed to proceed to Yellowstone Lake and place a monument at the east and south points of the lake, and then to measure in the most expeditious manner a distance of 10 miles east and south of these points for the boundary points.

The instruments were procured from the engineer depot at Willets Point, except one transit and level, which were obtained on memorandum receipts from Major Jones, Corps of Engineers, and embraced all the instruments for an elaborate survey of the Park.

I left Fort Yellowstone on July 4 and proceeded to the Lake Hotel to await the arrival of the instruments and the pack train and working party. While there I visited the southeast arm of the lake on Captain Waters' boat and located, approximately, the east and south points of the lake.

The instruments were forwarded to the lake July 16, and the train was ready and left the springs about July 8. I joined at the canyon, and with part of it ascended Mount Washburn and replaced the monument left by the Geological Survey with a substantial stone, one about 9 feet high and 5 feet in diameter.

The train reached the lake July 14, and, leaving its supplies for the boat to transport, proceeded along the east shore of the lake to Beaver Dam Creek.

In compliance with your telegram of the 14th of July I visited the Canyon Hotel and measured the width of the Yellowstone River in that vicinity for the purpose of locating a bridge there. A separate report on these measurements was submitted to you.

There was some delay in fitting out the boat, and it was not until July 22 that it was in a condition for use. This intervening time was employed in adjusting the instruments, determining stadia intervals, etc.

On July 22 the instruments required and the heavier freight was transported on the boat, and the whole party reunited in camp at the mouth of Beaver Dam Creek. The party under my charge consisted of 1 assistant engineer (Mr. Gignilliat), 1 chief packer, 2 packers, 1 rodman, and 3 axmen, with saddle horses for all and pack horses sufficient for transportation—about 20 in all.

The east point of the lake is sharply marked, and by inspection I placed a stake to mark that point. The upper Yellowstone empties into the lake about half a mile south of this point, and its course is northwest, the valley being bounded on both sides by a line of mountains 1,000 to 1,500 feet high, and the valley itself is about 3 miles wide. In the upper part it is covered with a thick growth of willows from 3 to 8 feet high, and for the most part is very marshy and soft. The river itself is impassable on account of its soft bottom. The upper part to the park line is higher and drier, and the willows are smaller and more scattered, with scattered bunches of timber. The mountains on both sides are steep and heavily timbered, with a good deal of fallen timber.

In view of these local characteristics I determined to measure the distance by triangulation, having one line of stations along the top of the hills and the other line along the valley as close to the river as I conveniently could, and this was the general method adopted.

A base line was selected about 1,400 feet long, measured, and its length reduced for temperature inclination and reduced to sea-level. The azimuth of this line was

determined by observations on Polaris at elongation. The eastern point was connected to this base, and from the base a series of triangles, whose sides were about a mile in length, was run up the valley to the approximate boundary of the park. The co-ordinates of this point were calculated and the error was measured in the proper direction and the boundary stone located.

As the instruments had to be carried by pack animals, I found it necessary to replace the large theodolite I had intended to use by a smaller transit instrument. This was one made by Brandis, with a 6-inch circle, reading to 20 seconds. It proved very reliable, and its results agreed very well with each other. All the angles were read four times, with the instrument reversed to eliminate errors. If the results did not check up, other readings were taken until the desired degree of accuracy was obtained.

The stations used were of three kinds. For the shorter sights a stake about 3 inches in diameter was driven in the ground, having the center marked with a long nail. For the longer sights a tripod was erected and a pole suspended from it and centered over the station.

Where the willows interfered with the sight and the instrument had to be elevated to obtain a sight, a post about 6 inches in diameter and 12 feet high was sunk in the ground and braced. Around this a platform was built consisting of four braced uprights with sufficient flooring.

The instrument was used without the tripod, centered over the center of the post and firmly fixed in position.

The general method of operations was to have Mr. Gignilliat, the assistant engineer, with several axmen, go ahead and erect the tripods at the stations previously selected, while I read the angles with the transit at the stations already located. The working hours were rather irregular, but in general were from 8 until 6, with about an hour for dinner.

The horses had to be collected in the morning and saddled and packed and luncheon had to be prepared by the cook for each party, and as it was not always possible to locate the camp in the immediate vicinity of the work considerable time was occupied in reaching the scene of the day's work. The difficult character of the country renders it rarely possible to construct more than two stations a day and to read the angles at the same number, and on some occasions a whole day would be consumed in the occupation of a single station. In this connection I wish to give credit to Mr. Gignilliat and all the members of the party. All of them took great interest in the work and performed very efficient services, often under difficult and trying situations.

The first camp was at Beaver Dam Creek, and from here the stations to the east for 2 miles were occupied. Then camp was moved July 26 to a point about 3 miles up the river and the stations to Trappers Creek were occupied. On July 29 camp was made on Trappers Creek, and on August 2 at Mountain Creek. From this camp the stations to the southern and eastern boundaries were occupied, and on August 8 the outfit returned to the original camp on the lake to get the monuments which were being cut. I returned to the Lake Hotel and worked up the results of triangulation, and left Mr. Gignilliat to construct the stations connecting the east and south points of the lake. I returned on the 10th of August, and from then until the 15th was occupied in reading at the stations between the east and south points and in putting up monuments to locate these points.

On the 15th camp was moved to Mountain Creek, and on the 16th to the headwaters of the creek, about half a mile outside of the park. Here two days were lost on account of rain.

The last station was calculated to be about 840 feet west of the east line. From this point a point on the boundary was located and the boundary line run across the valley of Mountain Creek. It runs through a dense growth of pines all the way, and after determining the compass variation it was run by compass. The small trees along the line were cut out and the large ones blazed.

The monument was placed on the south side of the creek about 20 feet from it in a clearing, and right on the creek a pile of stones with a post set up in the middle was placed to attract attention of those passing along the trail, which crosses the creek near this point.

On the 18th Mr. Gignilliat returned to the Lake Hotel and to the Springs on account of sickness. Camp was moved on the 22d of August to Mountain Creek, near the Yellowstone, and on the 23d to Thoroughfare Creek, about 3 miles from the Yellowstone.

The southern point of the triangulation was about 940 feet too far south. From this point a point on the southern boundary was fixed and the monument placed there and the south boundary run. Wherever the line crossed an open space it was marked by a post sunk into the ground and blazed, while through the woods it was marked by cutting and blazing the trees. Where it cuts the south span of the trident a stone monument about 8 feet high was placed with a post a foot in diameter in the center. This line had to be run by compass, as it was impossible to

obtain long sights on account of the smoke in the air, due to the forest fires in the vicinity. The monument is about a quarter of a mile east of the Yellowstone River, about in the center of the largest meadow, and is just east of a small clump of trees and a small pond.

The easternmost point of the triangulation in this vicinity was about a mile and a half west of the east boundary. From this point this distance was measured due east by tape, and from this point a portion of the eastern boundary run. Its intersection with the southern was marked by a monument. The point of crossing of the east boundary with Thoroughfare Creek is marked by a pile of stones on the creek with a post about a foot in diameter projecting. The monument is about half a mile due north of this pile of stones.

Camp was moved on the 29th of August to the lake, and with the heaviest stores of the outfit I returned to the Lake Hotel by boat, leaving the train to follow along the eastern shore. It reached the lake on the 1st of September, and I joined it on the 2d en route for the west point of Shoshone Lake. Mr. Gignilliat rejoined the party at this time.

The west point of Shoshone Lake was reached September 4 and the train went into camp that evening.

The west point of the lake is right at the geyser basin of Shoshone, and this point was easily determined by inspection. The west boundary of the park is 15 miles west of this point. The country for 3 miles west of the lake is steep, mountainous, and heavily covered with timber. Beyond this it is a sort of rolling prairie, with ridges running generally north and south covered with timber, and with dry ravines between the ridges. It is quite impossible to triangulate over the country, and so the method pursued consisted in measuring the required distance with the tape in a generally westerly direction, taking advantage of the open parks when possible.

A base line was measured near the shore of the lake and its azimuth determined, and the distance to the top of the ridge was determined by triangulation. From this point distances and azimuths were measured until about 2 miles east of the boundary. Here the line fell into a deep canyon about 3 miles wide, and this distance was measured by triangulation, a secondary base being located in the valley perpendicular to the course. From this base the required distance was measured to the boundary and the monument placed. It is in the deep canyon already mentioned opening out to the south, and from which the Three Tetons peaks are plainly visible. There is a small lake about 2 miles south of the monument and a little west of the western line. The monument is on a small knoll, and near it a dead tree was cut and squared to call attention to its place.

Camp was moved on the 7th of September to the top of the ridge spoken of, and on the 9th to a point about 5 miles west of the lake. Here one day was lost on account of a heavy fall of snow, and the work was impeded for the next two days on account of the snow on the ground. On the 14th camp was moved to a point near the western boundary, and from here work was completed on the 18th. On the 19th the outfit returned to the lake, and on the 20th to the Lone Star Geyser, and the next day I returned to the Lake Hotel by boat, leaving the train to follow by the road.

I reported to you by telegraph the completion of the work, and was directed to bring outfit to the Springs. I left the lake on the 23d, and arrived at the Springs on the 24th, and awaited your return to the Springs. On the 28th I reported to you in person and was relieved from the season's work, departing for my station the same night. The instruments, which may be required for the continuation of the work next season, were left for storage and safe-keeping with the post quartermaster.

The verification of the results of the triangulation has not yet been completed, as I have to await the arrival of some papers and books of reference which were to be shipped me here by the post quartermaster.

As soon as they are completed a copy will be sent you to be preserved in the office records.

Very respectfully, your obedient servant,

CHAS. S. BROMWELL,
First Lieutenant, Corps of Engineers.

Capt. GEORGE S. ANDERSON,
Sixth United States Cavalry, Fort Yellowstone, Wyo.

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